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Integration of metacognitive skills in the design of learning objects

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Abstract

Recent studies have demonstrated that specific instruction about metacognitive strategies improves achievement, the accuracy of knowledge monitoring, and the application of learning strategies in hypermedia environments. However, there are no models to date for instructional designers who design and develop learning objects for the incorporation of specific scaffolds to aid student reflection about their metacognitive skills; thus making it difficult to identify tasks to orientate learners in improving such skills. In this paper, we propose the use of specific ontologies as the basis for incorporating information about metacognition in learning objects so that a Learning Management System can select and recommend tasks designed for the development and/or improvement of the learners' metacognitive skills within the context of e-learning.

Keywords: Metacognition; Learning strategies; Learning objects; Adaptive e-learning

1. Introduction

Metacognition is defined as the ability of individuals to reflect, understand, and control their own learning (Schraw & Dennison, 1994). This ability implies, on the one hand, knowledge about one's self, about strategies that can be used, and about the application of such strategies (knowledge about cognition and self-monitoring); and on the other,

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control about the process of learning, which includes some kind of evaluation (regulation of cognition or control aspect) (Baker, 1991; Brown, 1978; Flavell, 1976). These general issues of metacognition have been analyzed in detail and broken down in very specific components, such as declarative knowledge, procedural knowledge, planning, monitoring, and more.

Published studies, in this line of research, have demonstrated that those learners who are aware of their metacognitive abilities are more effective learners and have increased achievement compared with average learners (Presley & Ghatala, 1990; Jones, Farquhar, & Surry, 1995). It has been stated that "the ability to monitor one's approach to problem solving—to be metacognitive—is an important aspect of the expert's competence" (Bransford, Brown, & Cocking, 2000, Chap. 2), assuming that an expert is "a person who has developed expertise in a particular area". In hypermedia environments, specific instruction about metacognitive strategies has demonstrated to improve, not only the learner's achievement, but also the accuracy of knowledge monitoring, and the application of learning strategies (Vovides, 2005).

As a result, the assessment of metacognitive abilities in the context of e-learning can be useful in determining which tasks should be set up for an individual learner in order to:

- Improve those aspects in the skill set that the learner has yet to master.
- Learn new strategies or skills that will facilitate the assimilation of concrete concepts during the learning process.
- Increase the learner's confidence in completing correctly certain tasks.
- Study in a more efficient manner relative to time spent and learning outcomes reached.

To evaluate the learners' perception about their own metacognitive skills, instruments such as the Metacognitive Awareness Inventory (MAI) proposed by Schraw and Dennison (1994) can be used. The MAI is a 52-item inventory that assesses students' metacognitive awareness. The MAI measures knowledge of cognition and regulation of cognition reliably. It provides measures of distinct sub-components of metacognition such as declarative knowledge, procedural knowledge, conditional knowledge, planning, information management strategies, monitoring, debugging strategies, and evaluation.

In the context of e-learning, where learning objects are becoming essential teaching materials, the results from an assessment such as the one offered via the MAI can be used as the basis for the creation of inferences by a Learning Management System (LMS). The goal is for, the LMS, in a mostly automated way, to recommend to the students certain assignments or tasks specifically addressing the acquisition of cognitive abilities. That is, the LMS would select certain learning objects based on the metacognitive skill-set that the learners would need to have. For example, if the results of a knowledge test were not satisfactory, the LMS would propose learning objects that entail activities for improving the learner's metacognitive skills for the purpose of improving achievement in future assessments. Recent studies by Valenti, Falsetti, Ramazzotti, and Leo (2006) have discussed the organization of learning objects in the realm of relevant research on metacognition. However, no relevant efforts have been identified to date about how to incorporate information about metacognition in learning objects so that a LMS can (in a semi-automated manner) select and recommend specific tasks.